

PROCEDURE 3 - Safe Electrical Work Practices

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Synopsis

This procedure provides guidelines related to electrical hazards in the workplace. The procedure applies to all NWS equipment, facilities, work locations, and employees.

Initial Implementation Requirements:

- **Analyze Site Operations versus Requirements of the Procedure**
 - Inspect/Test Electrical Equipment. (3.3.11o)
 - Perform Initial Ground-Fault Circuit Interrupters (GFCI) amperage testing. (3.3.19d)
- **Develop/Obtain Documentation/Information required for Site**
 - Develop Lockout/Tagout procedures utilizing the template in NWS Occupational Safety and Health Procedure # 4, “Control of Hazardous Energy Sources”(3.3.2e)
 - Ensure availability of Instrument Operator’s Manuals. (3.3.3)
- **Designate Person to Administer “Safe Electrical Work Practices” Procedure Requirements**
- **Provide Local Training of Site Personnel**
 - “Qualified” Personnel Training. (3.3.21a)
 - Safety Observers (3.3.21b)
 - Other Personnel (3.3.21c)
- **Inventory Material/Equipment (Procure as required)**
 - Insulating & Shielding Materials. (3.5.2e, 3.3.5a)
 - Barricades. (3.5.2e, 3.3.16b)
 - Safety Postings/Signs. (3.5.2e, 3.3.16a)
 - Personal Protective Equipment. (3.5.2e, 3.3.5a)
 - Insulated Tools. (3.5.2e, 3.3.5a)

Recurring and Annual Task Requirements:

- **Perform Inspection/Assessment/Testing**
 - Annual Inspections/Testing of Electrical Equipment. (3.3.11o)
 - Annual Ground-Fault Circuit Interrupters (GFCI) amperage testing. (3.3.19d)
- **Review/Update Documentation/Information required for Site**
 - Maintain Lockout/Tagout procedures for all applicable equipment on site. (3.3.2e)
- **Provide Refresher Training of Site Personnel**
 - “Qualified” Personnel Training. (3.3.21a)
 - Safety Observers (3.3.21b)
 - Other Personnel (3.3.21c)

Inspect/Replace/Maintain Material/Equipment

- Insulating & Shielding Materials. (3.5.2e, 3.3.5a)
- Barricades. (3.5.2e, 3.3.16b)
- Personal Protective Equipment. (3.5.2e, 3.3.5a)
- Insulated Tools. (3.5.2e, 3.3.5a)

Safe Electrical Work Practices Checklist

Requirements	Reference	YES	NO	N/A	Comments
Is initial and annual review of this procedure conducted and documented?	3.4.2				
Is equipment de-energized prior to being serviced or maintained?	3.3.2				
Are live parts that operate at less than 50 volts-to-ground de-energized if there is a safety risk?	3.3.2b				
Are circuit energizing parts locked-out and tagged-out during the process of de-energizing fixed electric equipment or circuits in accordance with the National Weather Services (NWS) Occupational Safety and Health Procedure # 4, "Control of Hazardous Energy Sources"?	3.3.2c				
Have procedures for Locking and Tagging of specific equipment been written, followed and maintained on file?	3.3.2e				
Is training of qualified individuals in proper Lockout/Tagout procedures conducted?	3.3.21a.4				
Are equipment operation manuals being used by employees to ensure proper de-energizing procedures?	3.3.3				
Are equipment de-energizing methods being followed by employees at the facility as described in the procedure?	3.3.3 a-d				

Requirements	Reference	YES	NO	N/A	Comments
Are equipment re-energizing requirements being followed by employees at the facility as described in the procedure?	3.3.4a-e				
Has safety training been provided for employees who work on energized equipment/circuit parts?	3.3.5				
Is correct Personal Protective Equipment (PPE) being used when working on energized equipment/circuits parts?	3.3.5				
Are correct shielding and insulating materials and tools being used when working on equipment/circuit parts that have not been de-energized?	3.3.5				
Are procedures for “working near energized equipment” being followed/used when work is being performed near overhead lines?	3.3.6				
Is adequate lighting provided when working near energized equipment?	3.3.8				
Are correct PPE, barriers and insulating materials being used when working in confined spaces that contain exposed energized equipment?	3.3.9				
Are proper safety procedures being followed when working on conductive material and equipment?	3.3.10a-b				
Are safety guidelines followed for the use of portable electric equipment?	3.3.11a-o				

Requirements	Reference	YES	NO	N/A	Comments
Are correct disconnecting means being used for routine opening, reversing, or closing circuits under load conditions?	3.3.12a				
Are correct equipment being used to disconnect a circuit under load?	3.3.12b				
Are safety checks being performed prior to re-energizing equipment /circuit to determine what caused a device to trip?	3.3.12c				
Is instrument/equipment testing being performed by a qualified person using equipment rated for the voltage and for the correct environment?	3.3.13				
Are appropriate signs and warning devices used to protect employees from electrical hazards?	3.3.16				
Is a minimum of 3 feet maintained in front of all 0-150 volt panels?	3.3.17				
Is a minimum of 4 feet maintained in front of all 151-600 volt panels?	3.3.17				
Are all ground conductors color coded according to the National Electrical Code?	3.3.18b				
Have grounding conductors been installed on all electrical equipment in accordance with this procedure?	3.3.18c				
Are neutral-to-ground bonds kept separate at all sub-panel board and junction box?	3.3.18d				

Requirements	Reference	YES	NO	N/A	Comments
Are GFCI devices installed in areas where frequent electrical maintenance occurs, as recommended by paragraph 3.3.19b?	3.3.19b				
Are GFCI devices utilized in damp locations and for all outside maintenance activities?	3.3.19a,c				
Are GFCI devices tested on annual basis to ensure proper operation?	3.3.19d				
Are correct safety/utilization procedures being used for GFI devices in accordance with this procedure?	3.3.20				
Have qualified individuals been properly trained as required by the procedure?	3.3.21a				

3 SAFE ELECTRICAL WORK PRACTICES

3.1 Purpose and Scope

As part of its goal to provide a safe and healthful workplace, the National Weather Service (NWS) is implementing this procedure related to electrical hazards in the workplace. This procedure applies to all NWS facilities, work locations and employees.

3.2 Definitions

Energized. Connected to an energy source or containing residual or stored energy.

Exposed. Energized part that is capable of being touched or approached nearer than a safe distance as specified in this procedure.

Field Office. A Field Office may include the following: Weather Forecast Office (WFO), River Forecast Center (RFC), Weather Service Office (WSO), and a Data Collection Office (DCO).

Ground-Fault Circuit-Interrupters (GFCI). Electrical receptacles designed to open the active (live) circuit when ground current exceeds a pre-established level, usually 5 milliamps. A current difference indicates that a path exists between the live circuit or an electrical component and ground. The current path could be an equipment short circuit or a human body making contact with an active circuit and ground.

Ground-Fault Interrupter (GFI). A GFI is an equipment protector, unlike the GFCI which is a personnel protector. It is intended to protect the equipment from damaging line-to-ground fault currents by opening all ungrounded conductors of the faulted circuit.

Ground. An electrically conducting connection between equipment or an electric circuit and the earth or to some other conducting body. A properly designed grounding system provides a reliable conducting path to earth or some other conducting body in place of the earth. This system provides a low impedance path for electric short circuits and faults enabling over-load protective devices to open the circuit. The grounding system maintains a common potential for grounded equipment at or near earth's potential level. It also provides a low impedance path for electrical short circuits, permitting large currents to pass through over-load protective devices permitting them to open.

Operating Unit. For the purpose of this procedure, Operating Unit includes the National Centers for Environmental Prediction (NCEP), National Data Buoy Center (NDBC), NWS Training Center (NWSTC), National Reconditioning Center (NRC), Radar Operations Center (ROC), or the Sterling Research & Development Center (SR&DC).

Qualified Person. A person who has received proper training and is permitted to work on or near exposed energized parts.

NOTE: Whether an employee is considered to be a "qualified person" will depend upon various circumstances in the workplace. It is possible that an individual is considered "qualified" with regard to certain equipment but is not "qualified" with regard to other equipment.

NOTE: An employee who is undergoing on-the-job training and who, in the course of such training, has demonstrated an ability to perform duties safely at his or her level of training and who is under the direct supervision of a "qualified" person is considered to be a "qualified" person for the performance of those duties.

Safety Observer. Under special conditions, when the risk of serious injury to maintenance personnel is judged to be greater than normal, the presence of a safety observer is essential. The safety observer should be able to obtain medical assistance or render emergency first aid. If there is a risk of serious injury that may adversely affect employee's respiration or cause severe bleeding or other life threatening condition, the safety observer must be trained in CPR/First Aid.

Station Manager. For the purpose of this procedure, the Station Manager shall be either the NWS Regional Director; Directors of Centers under NCEP (Aviation Weather Center, NP6; Storm Prediction Center, NP7; and Tropical Prediction Center, NP8); Directors of the NDBC, NWSTC, and Chiefs of NRC, ROC and SR&DC facilities; or Meteorologist in Charge (MIC), Hydrologist in Charge (HIC), or Official in Charge (OIC).

3.3 Procedure

3.3.1 Electrical Work Practices. Safety-related work practices shall be used to minimize the risk of electric shock or other injuries resulting from either direct or indirect electrical contacts when work is performed near or on equipment or circuits which are, or may be, energized.

3.3.2 De-Energized Parts. Live parts to which an employee may be exposed shall be de-energized before the employee works on or near them unless it can be shown that de-energizing introduces additional or increased hazards or is not feasible.

- a. The NWS requires that systems be de-energized except in an emergency. The Station Manager or designee is responsible for making the decision about de-energizing the equipment unless there is a specific regional or national policy about a particular piece of equipment.

- (1) Examples of *increased or additional hazards* include deactivation of emergency alarm systems, shutdown of hazardous location ventilation equipment, or removal of illumination from an area.

- (2) Example of work that may be performed on or near energized circuit parts because of *infeasibility due to equipment design or operational limitations* include testing of electrical circuits that can only be performed with the circuit energized and work on circuits that form an integral part of a continuous process that would otherwise need to be completely shut down in order to permit work on one circuit or piece of equipment.
 - b. Live parts that operate at less than 50 volts to ground need not be de-energized if there will be no increased exposure to electrical burns, explosions due to electric arcs, or risk of equipment damage. If any of these situations are possible, the equipment should be de-energized. A qualified person shall determine if de-energizing is necessary based on testing to show the number of amps and the amount of energy in the system and system configuration.
 - c. During the time an employee may be exposed to contact with parts of fixed electric equipment or circuits which have been de-energized, the circuits energizing the parts shall be locked out or tagged following NWS Occupational Safety and Health Procedure 4, "Control of Hazardous Energy Sources."
 - d. Conductors and parts of electric equipment that have been de-energized but have not been locked out or tagged following NWS Occupational Safety and Health Procedure 4, "Control of Hazardous Energy Sources" shall be treated as being energized.
 - e. Procedures for locking out or tagging the specific piece of equipment must be written, maintained and kept on file. A template for these procedures is included in NWS Occupational Safety and Health Procedure 4, "Control of Hazardous Energy Sources."
 - f. Interlocks for electric equipment shall not be used as a substitute for lockout and tagging procedures.
- 3.3.3 De-Energizing Equipment. Safe procedures for de-energizing circuits and equipment shall be determined before circuits or equipment are de-energized. The operating manual for the specific equipment shall be consulted for the proper method of de-energizing the equipment.
- a. The circuits and equipment to be worked on shall be disconnected from all electric energy sources.
 - b. Stored electric energy which might endanger personnel shall be released. Capacitors shall be discharged and high capacitance elements shall be short-circuited and grounded, if the stored electric energy might endanger personnel.

Example: B220 Transmitter upgrade. High voltage components in the power supply must be grounded to discharge filter capacitors to ensure power is not accidentally re-applied.

Example: ASOS Technical Information Package section 2.2, Voltage Precautions of the Automated Surface Observing System (ASOS) Technical Information Package, which instructs technicians to always ground circuits prior to handling because of the possibility of electrical charge after the power has been disconnected due to capacitors.

NOTE: Capacitors or associated equipment shall be treated as energized, until discharged as required in (b) above.

- c. Stored non-electrical energy in devices that could re-energize electric circuit parts shall be blocked or relieved commensurate with the probability that the circuit parts could be accidentally energized by the device.

Example: A spring-loaded contactor found on switches in main power distribution areas such as transformers and on some motor controls. Another example: When working on or around high voltage power supplies or equipment including cathode ray tubes, the tube should be de-energized and grounded at the anode while working on other parts of the equipment in the vicinity of the high voltage areas to ensure against accidental shock.

- d. All circuits and equipment must be tested to verify that they have been de-energized. All of the following steps shall be performed to ensure de-energizing is accomplished:
- e. A qualified person shall operate the equipment operating controls to verify that the equipment cannot be restarted.
- f. A qualified person shall use test equipment to test the circuit elements and electrical parts of equipment to which employees will, or may reasonably expect, to be exposed and shall verify that the circuit elements and equipment parts are de-energized.

NOTE: *If the circuit to be tested is over 600 volts nominal, the test equipment shall be checked for proper operation prior to and immediately after the test. An example of the test would be to check a circuit with a known voltage to ensure the instrument is reading properly. Always consult the instrument operator's manual for additional criteria to accomplish the test. Also see section 3.3.13. See 3.3.14 for personal protective equipment guidance.*

- 3.3.4 Re-Energizing Equipment. Prior to re-energizing circuits or equipment, even temporarily, the following requirements shall be met in the order listed:
- a. A qualified person shall verify that all tools, electrical jumpers, shorts, grounds and other similar devices have been removed so that the circuits and equipment can be safely energized, including removal of equipment interlock-defeating devices.
 - b. Individuals exposed to the hazards associated with re-energizing the circuit or equipment shall be warned to stay clear of circuits and equipment.
 - c. All locks and tags shall be removed as specified in NWS Occupational Safety and Health Procedure 4, "Control of Hazardous Energy Sources."
 - d. A visual check shall be made to ensure that all individuals are clear of the circuits and equipment.
 - e. Where appropriate, protective covers, shields, and shrouds should be secured, unless specific maintenance guidance states otherwise.
- 3.3.5 Energized Equipment. If the exposed energized parts cannot de-energized, an equivalent level of safety shall be provided to protect employees who may be exposed to the electrical hazards involved.
- Only qualified personnel may work on electric circuit parts or equipment that have not been de-energized. They shall be properly trained regarding working safely on energized circuits and shall be familiar with the proper use of special precautionary techniques, personal protective equipment, insulating and shielding materials and insulated tools as stated in 29 CFR 1910.333(c)(2). A safety observer trained in First Aid must be present if medical services are not readily available as specified in NWS Occupational Safety and Health Procedure 2, "Working Alone, section 2.3.2."
- 3.3.6 Overhead Lines. Work near overhead lines shall be avoided whenever possible. If work near overhead lines must be performed, the lines shall be considered to be energized and the requirements for working near energized equipment shall be followed. Emergency switches must be located to shut down the grid to overhead lines that employees will be working on or near.
- 3.3.7 Vehicular and Mechanical Equipment. When working near an energized overhead line, no part of a vehicle and mechanical equipment shall come within 10 feet of the line. This distance shall be increased by 4 inches for every 10kV over 50kV.
- 3.3.8 Lighting. An individual may not perform work near energized equipment unless the level of lighting is sufficient (at least 100 foot-candles) to enable the individual to work safely.
- a. A trouble light can be used to provide light and should be made of non-conducting material to avoid shorting conductors together. The flexible cord of

a portable lamp should never be pinched, kinked, cracked or cut, exposing live wires or parts.

- b. An individual shall not reach blindly into areas that may contain energized equipment.

- 3.3.9 Confined or Enclosed Work Spaces. Individuals working in a confined or enclosed space (such as a manhole or vault) that contains exposed energized equipment shall use protective shields, barriers or insulating materials to avoid inadvertent contact with the energized equipment.

Example: Individuals working inside of the cabinet where the main power feeds enter into the Weather Forecast Office. The conductors feeding the cabinet must be covered to prevent accidental contact.

Doors, covers, access panels, etc., shall be secured to prevent them from swinging into an employee and causing the employee to contact exposed energized parts.

Example: The access cover that must be removed when performing maintenance on the NEXRAD pedestal.

- 3.3.10 Conductive Materials and Equipment. Conductive materials and equipment shall be handled in a manner that will prevent them from contacting exposed energized conductors or circuit parts.

- a. If there are conductive objects in a work area where there are exposed live parts or circuits, the worker(s) shall use insulated blankets, insulated gloves and protective barriers to help minimize accidental contact with the exposed parts or circuits.
- b. Conductive articles of jewelry and clothing (e.g., watch bands, bracelets, rings, key chains or metal headgear) shall not be worn when working near electrical equipment.

- 3.3.11 Use of Portable Electric Equipment. Portable electric equipment such as drills, saws, and trouble lights shall be used in a safe manner and be connected to a circuit protected by GFCI capability (i.e., circuit breaker or separately enclosed, portable GFCI) unless UL listed as double insulated. The following guidelines provide minimum requirements for the use of this type of equipment.

- a. All cord and plug-connected electric equipment, flexible cord sets (extension cords), and portable electric equipment shall be handled in a manner that will not cause damage.

<p>NOTE: Adding an extension cord to a multi outlet assembly (e.g., power strip) in order to obtain more outlets is not a violation of NEC. However, each multiple outlet assembly has been electrically load calculated and, therefore, the overcurrent protection for that multiple outlet</p>

assembly must be upgraded. The same applies if one multiple outlet assembly is connected to another one. Multiple outlets shall not be “daisy-chained.” Use of extension cord in combination with power strip shall not be permitted.

- b. Flexible electric cords connected to equipment may not be used for raising or lowering the equipment.
- c. Flexible cords may not be fastened with staples or otherwise hung in a fashion that could damage the outer jacket or insulation.
- d. Portable cord- and plug-connected equipment and extension cords shall be visually inspected for external defects such as loose parts, deformed and missing pins, burns or scorch marks, or damage to outer jacket or insulation and for evidence of possible internal damage such as signs of pinching or crushing before use. However, cord- and plug-connected equipment and extension cords which remain connected once they are put in place and are not exposed to damage are not required to be visually inspected until they are relocated.
- e. If there is evidence of damage that might expose an employee to injury, the defective or damaged item shall be removed from service and not used until repaired and tested to ensure the equipment is safe.
- f. Whenever an attachment plug is to be connected to a receptacle (including extension cords), the plug end and the receptacle shall be checked to ensure that they are of proper configurations and that the fit is snug.
- g. An extension cord used with grounding-type equipment shall contain an equipment grounding conductor.
- h. Plugs and receptacles may not be connected or altered in a manner that would prevent proper continuity of the equipment grounding conductor at the point where plugs are attached to receptacles. (Do not cut off the ground prong on a plug) Additionally, those devices may not be altered to allow the grounding pole of a plug to be inserted into slots intended for connection to the current-carrying conductors.
- i. Adapters that do not allow continuity of the equipment grounding connection may not be used.
- j. Portable electric equipment and extension cords used in highly conductive work locations (such as areas with standing water), or in job locations where employees are likely to contact water shall be approved for those locations.
- k. Employees' hands may not be wet when plugging and unplugging flexible cords and cord- and plug-connected equipment if energized equipment is involved.

- l. Energized plug and receptacle connections may be handled only with insulating gloves if the condition of the connection could provide a conducting path to the employee's hand. For example, a cord connector is wet from being immersed in water.
- m. Locking-type connectors shall be properly secured after connection.
- n. All equipment shall have U. L. approval.
- o. At least once a year during a scheduled site visit, the qualified person shall test and inspect all electrical receptacles, cords and plugs to ensure that all ground circuits, pins, and sockets are properly wired and are in good repair and operating condition. Adapters that permit the ground pin of an electrical plug to be by-passed shall **not** be used. All electrical cords must not be frayed and must be in good repair.

NOTE: Ground currents usually exist because the grounding conductor is mis-wired as a neutral circuit or the grounding conductor is shorted to a neutral circuit permitting the current to return on the grounded conductor. These faults must be identified and corrected. Neutral currents should also be measured in 3-phase circuits to detect excessive phase imbalance and/or third harmonics. Use grounding cable on components that may retain a residual charge, making sure that the equipment is de-energized. In DC circuits, reverse polarity may cause damage to equipment or cause it to operate improperly. In AC reversing, the hot and neutral leads must be avoided on GFCI to ensure that they operate properly. More details on grounding protection can be found in EHB-3, Chapter 11, Grounding and Lightning Protection.

3.3.12 Electric Power and Lighting Circuits

- a. Load-rated switches (light switch), electrical disconnects and circuit breakers specifically designed as a disconnecting means shall be used for the routine opening, reversing, or closing of circuits under load conditions.
- b. Cable connectors not of the load-break type, fuses, terminal lugs, and cable splice connections may not be used to disconnect a circuit under load except in an emergency.
- c. After a circuit is de-energized by a circuit protective device (fuse, circuit breaker, thermal cutouts, etc.) the circuit may not be manually re-energized until it has been determined what caused the device to trip and if the equipment and circuit can be safely energized.
- d. Repetitive resetting of circuit breakers or re-energizing circuits through replaced fuses is prohibited.
- e. Overcurrent protection of circuits and conductors may not be modified, not even on a temporary basis.

- 3.3.13 Test Instruments and Equipment. Testing work on electric circuits or equipment may only be performed by qualified persons using equipment rated for the voltage which they will be testing and designed for the environment in which they will be used. Test instruments, equipment, associated test leads, cables, power cords, probes, and connectors shall be visually inspected for external defects and damage before the equipment is used. If there is a defect or evidence of damage that might expose an employee to injury, the defective or damaged item shall be removed from service until it can be repaired and tested
- 3.3.14 Personal Protective Equipment. Individuals shall be provided and shall use electrical protective equipment that is appropriate for the type work to be performed. Personal protective equipment shall be used and maintained in accordance with NWS Occupational Safety and Health Procedure 8, "Personal Protective Equipment."
- a. If the insulating capability of protective equipment may be subject to damage during use, the insulating material shall be protected, for example, an outer covering of leather when it is used for the protection of rubber insulating material.
 - b. Employees shall wear nonconductive head protection wherever there is a danger of head injury from electric shock or burns due to contact with exposed energized parts.
 - c. Employees shall wear protective equipment for the eyes or face wherever there is danger of injury to the eyes or face from electric arcs or flashes or from flying objects resulting from electrical explosion. Employees shall wear protective face and body equipment when working on equipment using chemicals such as battery acid or caustic fluids.
 - d. Employees shall wear approved protective equipment when working on equipment with live voltages over 50 volts (e.g., gloves approved for high voltage work, per 29 CFR 1910.335).
- 3.3.15 General Protective Equipment and Tools. When working near exposed energized conductors or circuit parts, each employee shall use insulated tools or equipment if they might make contact with conductors or parts.
- a. If the insulating capability of insulated tools or handling equipment is subject to damage, the insulating material shall be protected.
 - b. Fuse handling equipment, insulated for the circuit voltage, shall be used to remove or install fuses when the fuse terminals are energized.
 - c. Ropes and "fish tapes" used near exposed energized parts shall be nonconductive.
 - d. Protective shields, protective barriers or insulating materials shall be used to protect individuals working near exposed energized parts which might be

accidentally contacted or where dangerous electric heating or arcing might occur.

- e. When normally enclosed live parts are exposed for maintenance or repair, they shall be guarded to protect unqualified persons from coming in contact with the parts if they are still energized.

3.3.16 Alerting Techniques. The following techniques shall be used to warn and protect employees from hazards which could cause injury due to electric shock, burns or failure of electric equipment parts.

- a. Safety signs, safety symbols or accident prevention tags shall be used, where necessary, to warn individuals about electrical hazards in their work area. Signs, symbols and tags shall conform to the requirements of 29 CFR 1910.145, "Specifications for Accident Prevention Signs and Tags."

<p>NOTE: Typical signs warning of electrical hazards include red danger tape with the words: "Danger - Electrical Hazard" or "Danger - High Voltage" or "Danger- High Voltage - Authorized Personnel Only" or "Danger - Electrical Shock Hazard."</p>
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- b. Barricades shall be used in conjunction with safety signs where it is necessary to prevent or limit employee access to work areas exposing individuals to uninsulated energized equipment.

<p>NOTE: Conductive barricades may not be used where they might cause an electrical contact hazard.</p>
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- c. If signs and barricades do not provide sufficient warning and protection from electrical hazards, a safety observer or qualified person shall be stationed to warn and protect individuals from the potential hazard.

3.3.17 Clearances. A minimum of 3 feet shall be maintained in front of all 0-150 volt electrical panels that may be accessed periodically to perform maintenance on a circuit or to de-energize a circuit in an emergency. A minimum of 4 feet clear access to the front of all 151-600 volt panels shall be maintained.

3.3.18 Grounding. Grounding systems are intended to decrease the risk of electric shock to the human body from equipment and wiring.

- a. An Equipment Grounding Conductor (EGC) originating at the service equipment entrance or at the location of a separately derived system shall connect all non-current carrying metal equipment, enclosures, conduits, fittings, and metal outlets. This will provide the necessary electrical continuity required for the over-current devices to trip.

- b. The ground conductor shall be color coded green, green with a tracer color, or bare copper in accordance with the National Electric Code (NEC).
- c. Grounding conductors must be installed on all electrical equipment, including metal outlets and junction boxes, to comply with NEC and 29 CFR 1910.304 requirements.
- d. The only neutral-to-ground bond shall be at the service entrance and any separately derived source. The neutral and ground should be kept separate at all sub-panel boards and junction boxes. The only two locations where the neutral and ground are bonded together is at the main service entrance and at the secondary side of a separately derived system.
 - (1) Down line neutral-to-ground bonds result in parallel paths for the load return current where one of the paths becomes the ground circuit. This can cause a malfunction of protective devices and is a direct violation of the NEC.
 - (2) The Ground Electrode Conductor (GEC) will connect this neutral-to-ground bond to the facilities ground reference.

3.3.19 Ground-Fault Circuit-Interrupter (GFCI). GFCI receptacles are designed to open the active (live) circuit when ground current exceeds a pre-established level, usually 5 milliamps. Current on the ground wire indicates that a path exists between the live circuit or an electrical component and ground. The current path could be an equipment short circuit or a human body making contact with an active circuit and ground (e.g., touching a faulty double insulated power tool case).

- a. GFCI devices shall be used in wet or damp environments, or any other similar conditions, where the human body could accidentally come into contact with energized wiring or equipment and ground.
- b. Installing GFCI devices in areas where electrical maintenance is frequently performed is a good safety practice and is highly recommended.
- c. All outside maintenance work must be done with GFCI connections. As a minimum, NEC and local electric code requirements shall be followed.
- d. It is recommended that GFCI devices be self-tested with the testing indicator on GFCI device before each use. to determine at what amperage the circuit trips. GFCIs that trip above 6 milliamps should be replaced.

3.3.20 Ground-Fault Interrupter (GFI). GFIs shall be used when there is a requirement to protect equipment from damaging line-to-ground fault currents by opening all ungrounded conductors of the faulted circuit.

GFI devices shall be used in wet or damp locations. GFIs are addressed in the 1996 NEC, Article 230-95, which requires the installation of all solid-grounded wye

electrical services of more than 150 volts to ground, but not exceeding 600 volts, phase to phase for each service disconnect rated 1000 amperes or more.

3.3.21 Training.

- a. Initial training shall be given upon assignment to a position requiring an individual to work with or in close proximity to exposed electrical parts, equipment or conductors as a regular part of his/her job. Refresher training shall be given if there is a significant change in this procedure or work practices. Employees shall, at a minimum, be trained in, possess the knowledge of, and/or be familiar with the following to become “qualified” personnel:
 - (1) The skills, knowledge and techniques necessary to distinguish exposed live parts from other parts of electric equipment.
 - (2) The skills and techniques necessary to determine the nominal voltage of exposed live parts.
 - (3) The requirements specified in this procedure.
 - (4) Proper lockout/tagout procedures.
- b. Safety observers do not have to be proficient in the task being observed, but as a minimum, shall:
 - (1) Be briefed on and/or familiar with the potential hazards of the task and be able to detect an unsafe act or condition during the work.
 - (2) Know how to use electrical safety equipment and be familiar with procedures to remove personnel from electrical hazards and when **not** to touch an affected person.
 - (3) Be trained in basic first aid or First Aid/CPR based on conditions described in paragraph 2.3.2 (NOTE).
 - (4) Be familiar with local procedures for obtaining medical assistance.
 - (5) Know where disconnect switches are located and know how to de-energize equipment.
 - (6) Be familiar with and be able to recognize the appropriate safety controls (engineered and administrative) and to select personal protective equipment.
 - (7) Receive initial and refresher training (as appropriate).

- c. All other personnel shall be trained in the portions of this procedure that are necessary to ensure their safety. Refresher training shall be given if there is a significant change in work practices. This training should include but not be limited to:
 - (1) Warning signs indicating electrical hazards.
 - (2) The safe use of portable electrical equipment.
 - (3) Emergency notification procedures.

3.4 Quality Control

3.4.1 Regional or Operating Unit Environmental/Safety Coordinators

- a. Shall perform an annual assessment of the regional headquarters facilities or operating unit to monitor and promote compliance with the requirements of this procedure.
- b. Shall perform assessments or designate personnel to perform assessments of all field offices to monitor and promote compliance with the requirements of this procedure every two years.

3.4.2 Station Manager

Shall review, or delegate review, of this procedure on an annual basis to ensure that the facility is complying with its requirements. Confirmation of this review shall be forwarded to the Regional or Operating Unit Environmental/Safety Coordinator.

3.4.3 NWS Headquarters (NWSH)

- a. The NWS Safety Office shall perform an annual assessment of WSH facilities to ensure that the facilities are in compliance with this procedure.
- b. The NWSH Safety Office shall periodically perform an assessment of the regional headquarters and field offices to ensure compliance with this procedure. The frequency of these regional and field office assessments shall be determined by the NWSH Safety Office.
- c. Requests for clarification concerning this procedure shall be directed to the NWSH Safety Office.

3.5 Responsibilities

3.5.1 Regional or Operating Unit Environmental/Safety Coordinators*

Shall monitor and coordinate to promote compliance with the requirements of this procedure for the regional headquarters and field offices or operating units.

3.5.2 Station Manager*

- a. Shall have oversight over the implementation of this procedure and shall ensure that the requirements of this procedure are followed by individuals at the NWS facility.
- b. Shall ensure appropriate clearances are maintained when working near overhead lines and energized circuits.
- c. Shall ensure qualified personnel perform electrical work in accordance with the requirements of this procedure.
- d. Shall ensure qualified personnel are trained to a level that, at a minimum, meet the requirements of this procedure.
- e. Shall ensure that initial and periodic inventory of PPE, barricades, insulating and shielding materials, insulating tools is accomplished and adequate stock is maintained.

3.5.3 Safety or Environmental/Safety Focal Point*

Shall ensure that any responsibilities delegated to them by the Station Manager are implemented in accordance with the requirements of this procedure.

3.5.4 Employees

- a. Individual employees affected by this procedure are required to read, understand and comply with the requirements of this procedure.
- b. Report unsafe or unhealthful conditions and practices to their supervisor or safety focal point.

NOTE: * - Reference NWS PD 50-11 for complete list of responsibilities
<http://www.nws.noaa.gov/directives/050/pd05011a.pdf>

3.6 References

3.6.1 Incorporated References. The following list of references is incorporated as a whole or in part into this procedure. These references can provide additional explanation or guidance for the implementation of this procedure.

- a. National Fire Protection Association, NFPA 70, NEC.
- b. National Fire Protection Association, NFPA 70E, "Standard for the Electrical Safety Requirements for Employee Workplaces."
- c. U.S. Department of Labor, Occupational Safety and Health Administration, 29 CFR 1910.145, "Specifications for Accident Prevention Signs and Tags."

- d. U.S. Department of Labor, Occupational Safety and Health Administration, 29 CFR 1910.301 "Introduction."
- e. U.S. Department of Labor, Occupational Safety and Health Administration, 29 CFR 1910.302 "Electrical Utilization Systems."
- f. U.S. Department of Labor, Occupational Safety and Health Administration, 29 CFR 1910.303 "General Requirements."
- g. U.S. Department of Labor, Occupational Safety and Health Administration, 29 CFR 1910.304 "Wiring Design and Protection."
- h. U.S. Department of Labor, Occupational Safety and Health Administration, 29 CFR 1910.305 "Wiring Methods, Components, and Equipment for General Use."
- i. U.S. Department of Labor, Occupational Safety and Health Administration, 29 CFR 1910.306 "Special Purpose Equipment and Installations."
- j. U.S. Department of Labor, Occupational Safety and Health Administration, 9 CFR 1910.307 "Hazardous (classified) Locations."
- k. U.S. Department of Labor, Occupational Safety and Health Administration, 29 CFR 1910.308 "Special Systems."
- l. U.S. Department of Labor, Occupational Safety and Health Administration, 29 CFR 1910.331-335 "Safety-Related Work Practices."
- m. NWS Occupational Safety and Health Procedure 4, "Control of Hazardous Energy Sources."
- n. NWS Occupational Safety and Health Procedure 2, "Working Alone."
- o. NWS Occupational Safety and Health Procedure 8, "Personal Protective Equipment."

3.7 Attachments

None



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● [NDS 50-11 Occupational Safety and Health](#)

✓ [NDS 50-11 Occupational Safety and Health recertified January 5, 2004](#)

- [50-1115 Occupational Safety and Health](#)
 - [AR - Alaska Region Ice Measurement Safety](#)

● [NDS 50-51 Environmental Compliance](#)

✓ [NDS 50-51 Environmental Compliance recertified January 5, 2004](#)

- [50-5116 Environmental Management](#)

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